Opioid Prescribing for Chronic Pain in a Community-Based Healthcare System

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ABSTRACT

OBJECTIVES: We sought to evaluate opioid prescribing in an ambulatory setting among patients with noncancer chronic pain (CP).

STUDY DESIGN: Cross-sectional analysis.

METHODS: We identified patients with at least 2 CP encounters at least 30 days apart in 2012 in the electronic health records of a community-based healthcare delivery system in northern California. We used logistic regression models to assess associations of receiving an opioid prescription with respect to number and type of CP conditions and patient demographics and characteristics. Odds ratios (ORs) with 95% confidence intervals (CIs) and the adjusted prevalence of receiving an opioid prescription were generated after controlling for important covariates.

RESULTS: A total of 120,481 patients with CP met eligibility criteria, with 58% receiving an opioid in 2012. The adjusted prevalence of receiving an opioid was highest for back/cervical pain (71%). The odds of receiving an opioid increased linearly with the number of CP conditions per patient (OR, 1.29; 95% CI, 1.25-1.33; *P* <.001). Men were generally more likely to receive an opioid than women, as were patients with noncommercial insurance, especially Medicaid (OR, 2.77; 95% CI, 2.56-3.01; *P* <.001) versus commercial.

CONCLUSIONS: In an ambulatory healthcare setting, opioid prescribing to patients with CP varied by type and number of pain conditions. Opioid prescriptions to men, those with back/cervical pain, and Medicaid beneficiaries were particularly prevalent. The identification of populations more likely to receive an opioid in the treatment of CP should be of interest to healthcare systems to ensure these drugs are being used appropriately and safely.

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An estimated 25 million Americans—more than 10% of the adult population—experience pain on a daily basis.[1] In the United States, opioids are one of the most commonly prescribed drugs to treat pain, with nearly 260 million prescriptions written in 2012 alone.[2,3] In recent years, controversy around opioid prescribing has risen due to concerns about misuse, abuse, and diversion leading to opioid-related overdoses and deaths.[4,5] In 2014, there were 18,893 opioid overdose-related deaths in the United States, for an average of 50 per day.[6]

A systematic review conducted by the Agency for Healthcare Research and Quality in 2014, and a recent update to this review published by the CDC in 2016, showed limited evidence supporting the effectiveness of long-term opioid use for noncancer chronic pain (CP) lasting more than 3 months and indicated that risks for serious harms are dose-dependent.[7,8] Based on this evidence—or lack thereof—the CDC put forth guidelines for prescribing opioids for CP, with recommendations for weighing the benefits and risks of treatment, establishing treatment goals with patients, and prescribing the lowest effective opioid dosage, among others.[8]

Healthcare systems are challenged with ensuring that patients with CP receive appropriate treatment with positive clinical outcomes while keeping them safe from harm. Among barriers to adopting opioid practice guidelines, clinicians report inadequate training on pain management[9,10] and time constraints for comprehensive opioid risk assessment and drug monitoring, especially in busy primary care practices.[11,12] An understanding of populations that have a greater propensity for receiving opioid prescriptions may inform initiatives within healthcare systems to ensure that these drugs are used appropriately and safely. To our knowledge, no studies have been conducted to evaluate opioid prescribing across diverse CP conditions within a single healthcare setting.

Previously, we established a cross-sectional cohort of adult ambulatory patients with CP in 2012 from a large community-based healthcare system in northern California to calculate the prevalence of CP overall and by various CP conditions, including

back/cervical pain, arthritis/joint pain, neuropathies/neuralgias, headaches/migraines, and unclassified pain.[13] In the present study, we used this cohort to examine opioid prescribing, as well as prescribing of other pain medications. We explored differences in opioid prescribing by the number and types of CP conditions per patient and by patient demographics and characteristics.

TAKEAWAY POINTS

Opioid prescribing to patients with noncancer chronic pain (CP) in an outpatient setting varied by the number and type of pain conditions per patient, as well as by other patient characteristics.

- Opioid prescriptions for men, those with back/cervical pain, and Medicaid beneficiaries were particularly prevalent.
- Patients prescribed more than 5 medications were more likely to receive an opioid prescription than those prescribed fewer than 5 medications.
- The identification of populations more likely to receive an opioid in the treatment of CP is important information for healthcare systems working to ensure these drugs are being used appropriately and safely.

METHODS

Study Design and Setting

This study was conducted using Sutter Health electronic health record (EHR) data from 2012. Sutter Health is a community-based open-network healthcare system in northern California that provides ambulatory (primary and specialty) care across 130 medical clinics to approximately 3 million patients annually (10 million ambulatory visits in 2012). The system also provides care across 24 acute care hospitals, with 200,000 inpatient admissions and 800,000 emergency department visits in 2012. Similar to many other healthcare systems in the nation, Sutter Health is a mixed-payer organization with no single formulary; as such, this setting is appropriate to study drug prescribing patterns in a clinical population. Its EHR (EpicCare) is integrated across all ambulatory care clinics and hospitals. This study was approved by Sutter Health's Institutional Review Board, and all data were de-identified in accordance with Health Insurance Portability and Accountability Act standards.

Cohort Eligibility Criteria

Our study cohort was inclusive of adult patients with CP with a medical record in the EHR system. First, we identified patients 18 years or older with at least 2 *International Classification of Disease, 9th Revision, Clinical Modification* (*ICD-9 CM*) diagnoses for a CP condition at least 30 days apart in 2012. The *ICD-9 CM* codes for chronic pain conditions, by definition, exclude acute pain conditions and were based on well-described criteria from recent health system–based studies of CP,[13,14] as well as studies by White[15] and Davis.[16] A listing of these chronic pain diagnosis codes has been published previously.[13]

We required patients to have at least 1 encounter of any type before 2010 to confirm prior contact with the health system and to further characterize comorbidities and medication utilization. We excluded patients with an encounter or problem-list diagnosis of malignancy (with the exception of nonmelanoma skin cancer) in the 2 years prior to 2012 to restrict patients from the analysis with cancer-related pain. We also excluded patients with surgery in the 3 months prior to the first CP encounter in 2012 to restrict patients from the analysis with acute postsurgical pain.

Data Collection

Data were collected from the EHR, including information on prescribed medications and patient demographics (age, gender, and race/ethnicity) and characteristics (insurance type and comorbidities). Patient race/ethnicity was self-reported and collected as a part of routine clinical practice according to US Census standards. We categorized race/ethnicity as Hispanic (of any race), non-Hispanic white (NHW), African American, Asian, other (Pacific Islander, American Indian/Alaskan Native, multiple races reported, or race reported as "other"), and unknown. We further disaggregated the population's 6 largest Asian subgroups as East/Southeast Asian (Chinese, Japanese, Korean, Filipino, or Vietnamese) and Asian Indian. Charlson Comorbidity Index (CCI) scores were calculated for each patient as a measure of overall disease burden.[17] Insurance type was categorized as commercial (preferred provider organization/health maintenance organization), Medicare, Medicaid, Medicare/Medicaid dual eligible, or other/unknown (including self-pay). Patients were grouped into 5 non–mutually exclusive CP categories based on anatomical location and/or pathophysiology: arthritis/joint pain, back/cervical pain, neuropathies/neuralgias, headaches/migraines, and unclassified pain (including fibromyalgia, pelvic pain, abdominal pain, and general pain).

The primary outcome measures were medications prescribed for pain, categorized as analgesics (opioid and nonopioid agents) and nonanalgesics (benzodiazepines, antidepressants, muscle relaxants, antiepileptics, corticosteroids, antimigraine agents, antirheumatic agents, and topical agents). See the **eAppendix** (available at **ajmc.com**) for a listing of drug classes and, where appropriate, subclasses. Because data are from an open-network health system, we did not have comprehensive pharmacy claims data on this population and instead used EHR prescribing data. From a previous study of this cohort,[13] 56% of all outpatient visits were to a primary care physician (family or internal medicine); the remaining 44% of encounters spanned 20 different medical specialties and service lines.

Statistical Methods

We used descriptive statistics to summarize continuous and categorical variables and logistic regression to assess associations

TABLE 1. Demographics and Characteristics of the Chronic Noncancer Pain Cohort

	CP Cohort (n = 120,481)
Mean age, years ± SD	56.1 ± 16.8
Age distribution, n (%)	
18-45	34,170 (28.4)
46-65	51,917 (43.1)
≥66	31,394 (28.6)
Women, n (%)	79,605 (66.1)
Race/ethnicity, n (%)	
Non-Hispanic white	76,036 (63.1)
African American	4868 (4.04)
Hispanic, any race	12,771 (10.6)
East/Southeast Asian	6722 (5.58)
Asian Indian	3218 (2.67)
Other[a]	6501 (5.4)
Unknown	10,365 (8.6)
CP type categories,[b] n (%)	
Arthritis/joint pain	68,539 (56.9)
Back/cervical pain	58,925 (48.9)
Neuropathies/neuralgias	47,919 (39.8)
Headaches/migraines	27,261 (22.6)
Unclassified pain	23,677 (19.6)
Number of CP conditions by category, per patient, n (%)	
1	47,799 (39.7)
2	46,815 (38.9)
3	19,504 (16.2)
4	5435 (4.5)
5	928 (0.8)
CCI score, n (%)	
0	34,279 (28.4)
1-3	60,426 (50.2)
>3	25,776 (21.4)
Payer, n (%)	
Commercial	67,009 (55.6)
Medicare	12,779 (10.6)
Medicaid	4141 (3.44)
Medicare/Medicaid dual eligible	20,222 (16.8)
Other[c]/unknown	16,330 (13.55)
Any prescriptions, median (IQR)	11 (7, 18)

CCI indicates Charlson Comorbidity Index; CP, chronic noncancer pain; IQR, interquartile range; SD, standard deviation.
[a]Other race/ethnicities include Pacific Islander, American Indian/Alaskan Native, multiple races reported, or reported as "other."
[b]Categories are not mutually exclusive, as patients can have more than 1 type of CP condition.
[c]Other insurers include self-pay.

between receiving an opioid prescription and patient demographics/characteristics.[18] Models included receipt of an opioid in 2012 as the binary dependent variable. Independent variables included patient age, CCI score, total number of CP conditions by category per patient (ie, from 1-5), insurance type, and the number of other non–pain-related medications received during the study period. Because previous study results have shown differences in opioid use by gender and race/ethnicity,[19-21] we also explored these differences. We combined gender and race/ethnicity as a single variable in regression models to allow for different slopes for associations between opioid prescribing and racial/ethnic group by men and women (eg, NHW men, NHW women, Hispanic men, Hispanic women). This has the same consequence as an interaction term but with simpler interpretation of model coefficients. We also included categorical dummy variables in regression models for CP categories: arthritis/joint pain, back/cervical pain, neuropathies/neuralgias, and headaches/migraines. A dummy variable for unclassified pain was excluded due to collinearity with other CP categories.

We generated unadjusted and adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs) for univariate and multivariate associations, respectively. We compared model coefficients within levels of the gender and racial/ethnic category by posthoc estimation of linear combinations.[18] We derived the adjusted prevalence of receiving an opioid prescription from posthoc estimation of adjusted mean effects (holding constant the values of all other covariates).[18]

We repeated statistical models to estimate the adjusted prevalence of receiving an opioid by the number of total CP conditions for each category (eg, back/cervical pain alone, back/cervical pain plus 1 additional condition or plus 2 additional conditions). Because multiple tests were performed, we used a level of statistical significance of 0.01, instead of 0.05, to mitigate type 1 error (ie, the probability of falsely rejecting the null hypothesis of no difference). All analyses were performed in Stata version 13.0 (StataCorp; College Station, Texas).

RESULTS

Description of Study Population

Among 1,784,114 adult patients with an ambulatory record in the health system, 120,481 (6.8%) met study eligibility criteria for CP, which is the estimated prevalence of these conditions during the study period.[13] The most prevalent CP conditions by category were arthritis/joint pain (57%), back/cervical pain (49%), and neuropathies/neuralgias (40%) (**Table 1**). Approximately 40% of patients had a total of 1 or 2 CP conditions. Patients were aged 56 years on average; the majority were women (66%) and NHW (63%). Approximately half of the cohort comprised commercially insured

TABLE 2. Prescribed Pain Medications in the Chronic Noncancer Pain Cohort, Overall and by Five Pain Categories

Medication Type, n (%)	All Chronic Pain Patients (n = 120,481)	Arthritis or Joint Pain (n = 68,539)	Back or Cervical Pain (n = 58,925)	Neuropathies or Neuralgias (n = 47,919)	Headaches or Migraines (n = 27,261)	Unclassified Pain (n = 23,677)
Any pain medication	111,026 (92.2)	63,146 (92.1)	55,911 (94.9)	43,860 (91.5)	26,119 (95.8)	22,162 (93.6)
Any analgesics	99,838 (82.9)	58,474 (85.3)	52,228 (88.6)	40,175 (83.8)	21,999 (80.7)	19,934 (84.2)
Opioid analgesics						
Any opioid	69,935 (58.1)	40,482 (59.1)	40,062 (68.0)	28,001 (58.4)	15,938 (58.5)	15,551 (65.7)
Short-acting opioid	69,093 (57.4)	40,083 (58.5)	39,578 (67.2)	27,702 (57.8)	15,784 (57.9)	15,279 (64.5)
Long-acting opioid	8658 (7.2)	4911 (7.2)	5833 (9.9)	3611 (7.5)	11,943 (7.1)	3371 (14.2)
Nonopioid analgesics						
NSAIDs	75,820 (62.9)	46,829 (68.3)	39,643 (67.3)	31,695 (66.1)	15,486 (56.8)	14,637 (61.8)
Combination agents[a]	4003 (3.3)	1615 (2.4)	1703 (2.9)	1159 (2.4)	3096 (11.4)	916 (3.9)
Miscellaneous agents[b]	9735 (8.1)	6500 (9.5)	4807 (8.2)	4225 (8.8)	2047 (7.5)	2247 (9.5)
Analgesic count, mean ± SD	2.0 ± 1.7	2.3 ± 1.8	2.2 ± 1.7	2.1 ± 1.8	2.0 ± 1.8	2.3 ± 1.9
Any nonanalgesic	86,541 (71.8)	47,130 (68.8)	46,413 (78.8)	34,044 (71.0)	23,521 (86.3)	19,356 (81.8)
Nonanalgesics by class						
Antiepileptics	23,200 (19.3)	11,702 (17.1)	13,102 (22.2)	12,228 (25.5)	7273 (26.7)	6562 (27.7)
Antimigraine	13,678 (11.4)	4607 (6.7)	5272 (9.0)	3479 (7.3)	12,150 (44.6)	2897 (12.2)
Antirheumatics	5954 (4.9)	5428 (7.9)	1797 (3.1)	1614 (3.4)	797 (2.9)	1264 (5.3)
Benzodiazepine anxiolytics	34,419 (28.6)	18,635 (27.2)	19,958 (33.9)	13,641 (28.5)	9802 (36.0)	9577 (40.4)
Benzodiazepine hypnotics	9001 (7.5)	5760 (8.4)	4959 (8.4)	4105 (8.6)	1920 (7.0)	2523 (10.7)
Corticosteroids	19,591 (16.3)	12,609 (18.4)	10,823 (18.4)	8360 (17.4)	4592 (16.8)	4731 (20.0)
Muscle relaxers	29,772 (24.7)	15,110 (22.1)	22,600 (38.4)	11,331 (23.6)	7645 (28.0)	7762 (32.8)
Topical	8611 (7.2)	5401 (7.9)	5893 (10.0)	4121 (8.6)	1797 (6.6)	2789 (11.8)
SNRI	10,883 (9.0)	5918 (8.6)	6173 (10.5)	4576 (9.6)	3246 (11.9)	4275 (18.1)
SSRI	25,080 (20.8)	13,900 (20.3)	13,378 (22.7)	9828 (20.5)	7161 (26.3)	6430 (27.2)
Tricyclics	9576 (8.0)	4494 (6.6)	4813 (8.2)	3996 (8.3)	4191 (15.4)	3224 (13.6)
Nonanalgesic count, mean ± SD	1.8 ± 1.8	1.7 ± 1.9	2.1 ± 2.0	1.8 ± 1.9	2.6 ± 2.2	2.6 ± 2.3

NSAID indicates nonsteroidal anti-inflammatory drug; SD, standard deviation; SNRI, serotonin norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor.
[a]Combination agents include acetaminophen and aspirin-containing products.
[b]acetaminophen, salicylamide, or ziconotide.

beneficiaries. Patients were prescribed a median of 11 unique (pain and nonpain) medications during the study period.

Analgesic and Nonanalgesic Prescribing by CP Category

Across all CP categories, most patients (92%) received an analgesic or nonanalgesic medication (**Table 2**). Nonsteroidal anti-inflammatory drugs (NSAIDs) were the most commonly prescribed medications (68%), followed by short-acting (immediate-release) opioids (57%); 58% received a short- or long-acting (extended-release) opioid.

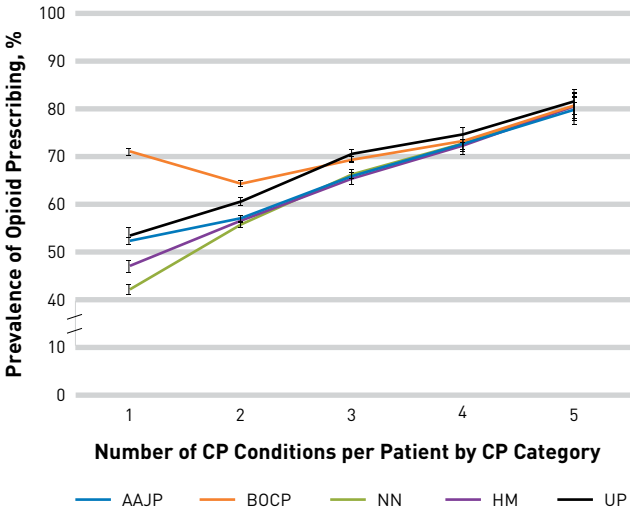
Analgesics (opioid or nonopioid) (89%), any opioid (68%), and, specifically, short-acting opioids (67%) were most common in patients with back/cervical pain (Table 2). Patients received, on average, 2 analgesics during the study period; those with arthritis/joint pain and unclassified pain had the highest average number of prescriptions for analgesic medications (mean = 2.3 each for arthritis/joint pain and unclassified pain).

Prescriptions for nonanalgesics were most common in patients with headaches/migraines (86.3%) (Table 2). Patients were prescribed, on average, 1.8 unique nonanalgesic medications; those with headaches/migraines and unclassified pain received the highest average number of nonanalgesic medications (mean = 2.6 each for arthritis/joint pain and unclassified pain).

Opioid Prescribing by Number and Type of CP Conditions

Among patients with a single CP type, the highest prevalence of receiving an opioid, after controlling for other covariates, was for back/cervical pain (71%) (**Figure**). For each CP category, the adjusted prevalence of receiving an opioid increased linearly as the number of CP conditions increased: arthritis/joint pain

FIGURE. Adjusted Prevalence of Receiving an Opioid Prescription by Number and Type of Noncancer Chronic Pain Conditions by Category[a,b,c]



AAJP indicates arthritis/joint pain; BOCP, back/cervical pain; CP, noncancer chronic pain; HM, headache/migraine; NN, neuropathy/neuralgia; UP, unclassified pain.

[a]Adjusted mean effects were estimated from logistic regression models, with receiving an opioid prescription as the binary dependent variable and total number of CP conditions as the main predictor variable.

[b]Statistical adjustment was performed for age, sex and race/ethnicity, overall comorbidity, insurance payer, and total number of prescriptions. Models were run separately for each CP category: AAJP, BOCP, NN, HM, and UP.

[c]Error bars represent 95% confidence intervals.

(OR, 1.39; 95% CI, 1.36-1.42; P <.001), back/cervical pain (OR, 1.07; 95% CI, 1.05-1.09; P <.001), neuropathies/neuralgias (OR, 1.65; 95% CI, 1.61-1.69; P <.001), headaches/migraines (OR, 1.51; 95% CI, 1.47-1.56; P <.001), and unclassified pain (OR, 1.48; 95% CI, 1.44-1.53; P <.001).

Patient Demographics and Characteristics Associated With Receiving an Opioid Prescription

We found several patient demographics and characteristics to be associated with receipt of an opioid prescription (**Table 3**). After statistical adjustment, older patients (≥66 years vs 18-45 years), those with moderate chronic disease burden (CCI score = 2-3 vs 0), women, Asians (vs NHW), and commercially insured beneficiaries (vs all other insurance types) had lower odds of receiving an opioid. Patients with a greater total number of CP conditions had higher odds of receiving an opioid.

Because of the potential correlation between age, CCI score, and insurance type (eg, older individuals tend to have more comorbidities and are more likely to be Medicare beneficiaries), we performed analyses to examine the effect of CCI and payer type on the relationship between age and receipt of an opioid. The presence or absence of these covariates had minimal effect on model coefficients within the age category (data not shown).

DISCUSSION

In this cross-sectional analysis of EHR prescribing data from a community-based ambulatory healthcare system setting, we found differences in opioid prescribing to patients by number and type of CP conditions. Among patients with 1 CP condition, those with back/cervical pain had the highest prevalence of receiving an opioid, whereas those with neuropathies/neuralgias and headache/migraines had the lowest prevalence; these latter groups more frequently received nonanalgesic medications (eg, antiepileptic or antimigraine medications). The prevalence of receiving an opioid increased linearly with the number of CP conditions per patient, reaching more than 60% for those with 3, more than 70% for those with 4, and approximately 80% for those with all 5 CP conditions; however, few patients had conditions within 4 or all 5 CP categories (4.5% and 0.8%, respectively).

Our study is consistent with previous studies showing that patients with back pain are more likely to receive an opioid than those with other pain conditions.[19,22] Back pain is one of the most common reasons for a visit to a doctor's office, composing approximately one-fourth of all encounters.[23] Higher rates of opioid prescribing among patients with back pain may be due to the paucity of effective alternative pharmacological agents, particularly for back pain lasting more than 4 weeks.[24] In general, opioid prescribing for all types of chronic musculoskeletal pain has increased 2-fold between 1980 and 2000 (8% to 16%).[25,26]

These trends reflect an increased availability of newly marketed pain products in the 1990s and changes to state medical board opioid regulations around the same time, which relaxed opioid prescribing practices for CP.[27] It is notable that more than half of patients with only unclassified pain—inclusive of conditions like fibromyalgia and pelvic pain—received an opioid; these patients had the highest prevalence of prescriptions for long-acting opioids (14.2%). Current guidelines do not support the use of most opioids in unclassified painful conditions where the harms may outweigh potential benefits, regardless of whether other treatments had been previously tried.[8] The exception is tramadol, which has serotonin and norepinephrine reuptake inhibitory effects and is used in the treatment of fibromyalgia.

In multivariate analyses, we found that older age and higher CCI score were negatively associated with receiving an opioid. Although older individuals may be expected to have a greater need for pain medications due to higher prevalence of painful conditions and greater overall disease burden,[28] certain medications, including opioids, are not recommended in the elderly population due to increased risks.[29] For example, opioid-related risks, such as respiratory depression, tend to be potentiated in older patients.[30-32] Even minor side effects, including opioid-induced drowsiness or sedation, may have more serious consequences in this population. Similarly, older patients and those with a higher CCI may be more

TABLE 3. Results From Opioid Prescribing Logistic Regression Model[a]

	Unadjusted OR[b] (95% CI)		Adjusted OR[b] (95% CI)		Adjusted Prevalence,[c] %
Age, years					
18-45	Ref		Ref		62.0
46-65	1.16 (1.12-1.19)[d]		0.95 (0.91-0.99)		61.0
≥66	1.10 (1.07-1.13)[d]		0.55 (0.52-0.58)[d]		49.3
Men's race/ethnicity[e]					
Non-Hispanic white	Ref		Ref		63.0
African American	1.15 (1.03-1.29)		1.04 (0.92-1.16)		63.8
Hispanic, any race	1.07 (1.01-1.15)		1.06 (0.98-1.14)		64.2
East/Southeast Asian	0.34 (0.31-0.37)[d]		0.37 (0.33-0.40)[d]		41.1
Asian Indian	0.26 (0.23-0.29)[d]		0.29 (0.25-0.33)[d]		36.0
Other race	0.96 (0.87-1.05)		0.92 (0.84-1.01)		61.3
Unknown race	0.75 (0.70-0.80)[d]		0.84 (0.78-0.90)[d]		59.3
		vs Men of Same Race/Ethnicity		vs Men of Same Race/Ethnicity	
Women's race/ethnicity					
Non-Hispanic white	Ref	0.97 (0.95-1.01)	Ref	0.83 (0.80-0.85)[d]	59.0
African American	1.27 (1.18-1.36)[d]	1.07 (0.94-1.22)	1.13 (1.04-1.22)[f]	0.90 (0.79-1.03)	61.6
Hispanic, any race	0.99 (0.94-1.04)	0.90 (0.83-0.97)[f]	0.94 (0.90-0.99)	0.74 (0.68-0.80)[d]	57.7
East/Southeast Asian	0.35 (0.32-0.37)[d]	0.99 (0.89-1.11)	0.37 (0.34-0.39)[d]	0.83 (0.74-0.93)[f]	37.1
Asian Indian	0.31 (0.29-0.35)[d]	1.19 (1.02-1.39)	0.35 (0.31-0.38)[d]	0.99 (0.85-1.16)	35.8
Other race	1.00 (0.94-1.06)	1.02 (0.91-1.13)	0.91 (0.85-0.97)[f]	0.81 (0.73-0.91)[d]	56.9
Unknown race	0.73 (0.69-0.77)[d]	0.96 (0.89-1.04)	0.81 (0.77-0.86)[d]	0.80 (0.74-0.87)[d]	54.4
Total number of CP types per patient, count	1.48 (1.46-1.50)[d]		1.29 (1.25-1.33)[d]		–
CCI score					
0	Ref		Ref		59.0
1-3	1.16 (1.13-1.19)[d]		0.92 (0.88-0.96)[d]		57.1
>3	1.34 (1.30-1.39)[d]		0.99 (0.94-1.05)		58.8
Payer					
Commercial	Ref		Ref		53.0
Medicare	1.47 (1.41-1.53)[d]		1.64 (1.56-1.72)[d]		63.6
Medicaid	3.45 (3.19-3.73)[d]		2.77 (2.56-3.01)[d]		73.7
Dual eligible	1.52 (1.47-1.57)[d]		1.62 (1.55-1.69)[d]		63.4
Other/unknown	1.53 (1.48-1.59)[d]		1.69 (1.63-1.76)[d]		64.2
Other prescriptions, count					–
<5	Ref		Ref		42.4
5-10	1.54 (1.49-1.59)[d]		1.58 (1.52-1.63)[d]		57.8
>10	3.27 (3.16-3.38)[d]		3.27 (3.15-3.40)[d]		68.7

CCI, Charlson Comorbitidy Index; CI, confidence interval; CP, noncancer chronic pain; OR, odds ratio; Ref, referent group.
[a]Models included dummy variables for each CP category: arthritis/joint pain, back/cervical pain, neuropathies/neuralgias, and headaches/migraines (not shown). A dummy variable for unclassified pain was excluded due to collinearity.
[b]The OR of receiving opioid prescription and 95% CIs were generated from logistic regression models for each covariate, independently (unadjusted) and combined (adjusted).
[c]Adjusted prevalences of receiving an opioid were estimated by posthoc estimation of adjusted effects from multivariate logistic regression models for each categorical variable, conditional on all other covariates.
[d]$P < .001$.
[e]Comparisons across levels of the gender and race/ethnicity category were performed by postestimation of linear combinations.
[f]$P < .01$.

likely to have underlying liver or renal disease, which can impact opioid metabolism and lead to harmful effects.[31]

We also found that for most racial/ethnic groups, men received an opioid prescription more often than women. This trend has been demonstrated in other studies of CP.[19,20] We further showed that among men, there were no significant differences in the adjusted prevalence of receiving an opioid for NHWs, African Americans, or Hispanics; however, among women, African Americans were more likely than NHWs to receive an opioid. Notably, East/Southeast Asians and Asian Indians of both genders had the lowest prevalence of receiving opioid prescriptions.

We are unaware of studies on this topic among Asians receiving treatment for CP in ambulatory settings, but the results of a small prospective cohort study from an inpatient postoperative setting showed that Chinese patients required lower opioid doses, yet were more likely to experience opioid-induced pruritus than a matched group of Caucasians.[21] Differences in opioid metabolism have been described previously for Asians relative to Caucasians[33-35]; however, sociocultural factors may also explain disparities in opioid prescribing.[36] Future studies are needed to understand whether physicians are less likely to prescribe opioids to Asians because of perceived risks or if Asians are less accepting of these medications.

In our analysis, Medicaid beneficiaries were more likely than patients with other insurance types to receive opioids, even after controlling for other factors. CMS has reported that these beneficiaries are twice as likely to receive an opioid prescription than non-Medicaid patients.[37] Another notable finding was that the number of nonpain medications prescribed was positively associated with an increase in opioid prescribing. This is contrary to expectations, but may be related to higher levels of comorbidity in patients who receive opioids. Further investigation of this finding is required.

To our knowledge, this is the first study to evaluate opioid prescribing across a range of conditions with distinct CP categories. We analyzed data from a large ambulatory care cohort and used rigorous methods to classify and identify patients with painful chronic conditions. Furthermore, data were derived from a mixed-payer organization with no single formulary, making it an appropriate setting for evaluating patterns in opioid prescribing.

Limitations

This was a cross-sectional analysis and causal inferences are restricted. Also, the study population was from a relatively small geographic area and generalizability to other parts of the United States is unknown; however, as a mixed-payer healthcare system, the setting is like many others in the nation. The findings of this study are reliant on the accuracy of, and frequency at which physicians document, information in the EHR. Because pharmacy data were not available on the majority of the population, we relied on prescribing data, meaning we cannot know what medications patients actually filled or consumed. We also cannot know whether nonanalgesic medications were prescribed to treat pain or comorbid conditions, such as epilepsy, depression, or anxiety. We did not specifically collect information on the type of provider who prescribed the drug, as the focus of this study was not on provider-level attributes of opioid prescribing. Lastly, we did not have information on over-the-counter medications, such as NSAIDs or acetaminophen, which were potentially used by patients to treat CP and may have influenced whether a prescription pain medication was warranted.

CONCLUSIONS

In this cross-sectional analysis in an ambulatory healthcare setting, opioid prescribing to patients varied by type of CP condition. The prevalence of receiving an opioid increased linearly with the number of CP conditions. Opioid prescriptions for men, those with back/cervical pain, and Medicaid beneficiaries were particularly prevalent. The identification of populations likely to receive an opioid for CP should be of interest to healthcare systems to ensure these drugs are used appropriately and safely. ■

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REFERENCES

1. Nahin RL. Estimates of pain prevalence and severity in adults: United States, 2012. *J Pain.* 2015;16(8):769-780. doi: 10.1016/j.jpain.2015.05.002.
2. Vital signs: opioid painkiller prescribing: where you live makes a difference. CDC website. http://www.cdc.gov/vitalsigns/opioid-prescribing/. Published July 1, 2014. Accessed April 2, 2016.
3. Levy B, Paulozzi L, Mack KA, Jones CM. Trends in opioid analgesic-prescribing rates by specialty, U.S., 2007-2012. *Am J Prev Med.* 2015;49(3):409-413. doi: 10.1016/j.amepre.2015.02.020.
4. Treatment episode data set (TEDS), 1998-2008: national admissions to substance abuse treatment services. Substance Abuse and Mental Health Services Administration website. https://wwwdasis.samhsa.gov/dasis2/teds_pubs/2008_teds_rpt_natl.pdf. Published April 2010. Accessed April 21 2017
5. Center for Behavioral Health Statistics and Quality. The DAWN report: highlights of the 2010 Drug Abuse Warning Network (DAWN) findings on drug-related emergency department visits. Substance Abuse and Mental Health Services Administration website. https://www.samhsa.gov/data/sites/default/files/DAWN096/DAWN096/SR096EDHighlights2010.pdf. Published July 2, 2012. Accessed April 21, 2017.
6. Number and age-adjusted rates of drug-poisoning deaths involving opioid analgesics and heroin: United States, 2000-2014. CDC website. https://www.cdc.gov/nchs/data/health_policy/AADR_drug_poisoning_involving_OA_Heroin_US_2000-2014.pdf. Published 2015. Accessed on April 21, 2017.

7. The effectiveness and risks of long-term opioid treatment of chronic pain: evidence report number 218. Agency for Healthcare Research and Quality website. https://www.effectivehealthcare.ahrq.gov/ehc/products/557/1971/chronic-pain-opioid-treatment-report-141205.pdf. Published September 2014. Accessed April 2, 2016.
8. Dowell D, Haegerich TM, Chou R. CDC guidelines for prescribing opioids for chronic pain—United States, 2016. *JAMA.* 2016;315(15):1624-1645. doi: 10.1001/jama.2016.1464.
9. Paulozzi LJ, Kilbourne EM, Shah NG, et al. A history of being prescribed controlled substances and risk of drug overdose death. *Pain Med.* 2012;13(1):87-95. doi: 10.1111/j.1526-4637.2011.01260.x.
10. Upshur CC, Luckmann RS, Savageau JA. Primary care provider concerns about management of chronic pain in community clinic populations. *J Gen Intern Med.* 2006;21(6):652-655.
11. Glajchen M. Chronic pain: treatment barriers and strategies for clinical practice. *J Am Board Fam Pract.* 2001;14(3):211-218.
12. McJunkin B, Riley MA, Lilly JK, Casto A, Bowe A. Approach to pain management in a large outpatient clinic population. *W V Med J.* 2010;106(spec no 4):72-78.
13. Romanelli RJ, Shah SN, Ikeda L, et al. Patient characteristics and healthcare utilization of a chronic pain population within an integrated healthcare system. *Am J Manag Care.* 2017;23(2):e50-e56.
14. Lamerato LE, Dryer RD, Wolff GG, et al. Prevalence of chronic pain in a large integrated healthcare delivery system in the U.S.A. *Pain Pract.* 2016;16(7):890-898. doi: 10.1111/papr.12334.
15. White AG, Birnbaum HG, Mareva MN, Henckler AE, Grossman P, Mallett DA. Economic burden of illness for employees with painful conditions. *J Occup Environ Med.* 2005;47(9):884-892.
16. Davis JA, Robinson RL, Le TK, Xie J. Incidence and impact of pain conditions and comorbid illnesses. *J Pain Res.* 2011;4:331-345. doi: 10.2147/JPR.S24170.
17. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis.* 1987;40(5):373-383.
18. Hosmer DW, Lemeshow S, Sturdivant RX. *Applied Logistic Regression.* 3rd ed. Hoboken, NJ: Wiley; 2013.
19. Ringwalt C, Gugelmann H, Garrettson M, et al. Differential prescribing of opioid analgesics according to physician specialty for Medicaid patients with chronic noncancer pain diagnoses. *Pain Res Manag.* 2014;19(4):179-185.
20. Back SE, Payne RL, Simpson AN, Brady KT. Gender and prescription opioids: findings from the National Survey on Drug Use and Health. *Addict Behav.* 2010;35(11):1001-1007. doi: 10.1016/j.addbeh.2010.06.018.
21. Konstantatos AH, Imberger G, Angliss M, Cheng CH, Meng AZ, Chan MT. A prospective cohort study comparing early opioid requirement between Chinese from Hong Kong and Caucasian Australians after major abdominal surgery. *Br J Anaesth.* 2012;109(5):797-803. doi: 10.1093/bja/aes261.
22. Campbell CI, Weisner C, Leresche L, et al. Age and gender trends in long-term opioid analgesic use for noncancer pain. *Am J Public Health.* 2010;100(12):2541-2547. doi: 10.2105/AJPH.2009.180646.
23. St Sauver JL, Warner DO, Yawn BP, et al. Why patients visit their doctors: assessing the most prevalent conditions in a defined American population. *Mayo Clin Proc.* 2013;88(1):56-67. doi: 10.1016/j.mayocp.2012.08.020.
24. Chou R, Huffman LH; American Pain Society; American College of Physicians. Medications for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. *Ann Intern Med.* 2007;147(7):505-514.
25. Luo X, Pietrobon R, Hey L. Patterns and trends in opioid use among individuals with back pain in the United States. *Spine (Phila Pa 1976).* 2004;29(8):884-890; discussion 891.
26. Caudill-Slosberg MA, Schwartz LM, Woloshin S. Office visits and analgesic prescriptions for musculoskeletal pain in US: 1980 vs. 2000. *Pain.* 2004;109(3):514-519.
27. Joranson DE, Gilson AM, Dahl JL, Haddox JD. Pain management, controlled substances, and state medical board policy: a decade of change. *J Pain Symptom Manage.* 2002;23(2):138-147.
28. Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an internet-based survey. *J Pain.* 2010;11(11):1230-1239. doi: 10.1016/j.jpain.2010.07.002.
29. American Geriatrics Society Beers Criteria Update Expert Panel. American Geriatrics Society 2015 updated Beers Criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc.* 2015;63(11):2227-2246. doi: 10.1111/jgs.13702.
30. Gianni W, Ceci M, Bustacchini S, et al. Opioids for the treatment of chronic non-cancer pain in older people. *Drugs Aging.* 2009;26(suppl 1):63-73. doi: 10.2165/11534670-000000000-00000.
31. Pergolizzi J, Boger RH, Budd K, et al. Opioids and the management of chronic severe pain in the elderly: consensus statement of an international expert panel with focus on the six clinically most often used World Health Organization Step III opioids (buprenorphine, fentanyl, hydromorphone, methadone, morphine, oxycodone). *Pain Pract.* 2008;8(4):287-313. doi: 10.1111/j.1533-2500.2008.00204.x.
32. Cepeda MS, Farrar JT, Baumgarten M, Boston R, Carr DB, Strom BL. Side effects of opioids during short-term administration: effect of age, gender, and race. *Clin Pharmacol Ther.* 2003;74(2):102-112.
33. Zhou HH, Sheller JR, Nu H, Wood M, Wood AJ. Ethnic differences in response to morphine. *Clin Pharmacol Ther.* 1993;54(5):507-513.
34. Johnson JA. Influence of race or ethnicity on pharmacokinetics of drugs. *J Pharm Sci.* 1997;86(12):1328-1333.
35. Smith HS. Opioid metabolism. *Mayo Clin Proc.* 2009;84(7):613-624. doi: 10.1016/S0025-6196(11)60750-7.
36. Campbell CM, Edwards RR. Ethnic differences in pain and pain management. *Pain Manag.* 2012;2(3):219-230.
37. Best practices for addressing prescription opioid overdoses, misuse and addiction. Medicaid.gov website. https://www.medicaid.gov/federal-policy-guidance/downloads/cib-02-02-16.pdf. Published January 28, 2016. Accessed April 2, 2016.

eAppendix

Drug Categories
Analgesic
Nonsteroidal Anti-inflammatory Drugs (NSAIDS)
Opioid analgesics ▪ Short-acting ▪ Long-acting
Combination analgesics ▪ Acetaminophen/aspirin/caffeine-containing products
Other analgesics ▪ Acetaminophen ▪ Salicylamide ▪ Ziconotide
Nonanalgesics
Benzodiazepines ▪ Anxiolytics ▪ Hypnotics
Antidepressants ▪ Selective serotonin reuptake inhibitors ▪ Serotonin-norepinephrine reuptake inhibitors ▪ Tricyclics
Muscle relaxers
Antiepileptic agents
Corticosteroids
Antimigraine agents
Antirheumatic agents ▪ Immunomodulators ▪ Biologics
Other nonanalgesics ▪ Topical creams ▪ Patches